INCH-POUND

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SUPERSEDING
MIL-PRF-/1553C
9 July 1999

PERFORMANCE SPECIFICATION SHEET

ELECTRON TUBE, POWER
TYPE 7651

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the electron tube described herein shall consist of this document and the latest issue of MIL-PRF-1.

DESCRIPTION: Tetrode, ceramic-metal.

See figure 1.

Mounting position: Any.

Weight: 12 ounces (340.2 grams) nominal.

ABSOLUTE RATINGS: 1/

Parameter:	F	Ef	Eb	eb	Ec2	ec2	Ec1
Unit:	MHz	V	V dc	v	V dc	v	V dc
Maximum: Pulsed: RF amplifier	1,215	---	5,000	8,000	1,200	1,200	-250
Test conditions:	---	6.3	2,500	---	1,000	---	Vary

ABSOLUTE RATINGS: 1/

Parameter:	Ib	DC anode current during pulse	Pg2	Pg1	Pp	tk	T(seal)	Barometric pressure, reduced
Unit:	A dc	A	W	W	W	sec	°C	mmHg
Maximum: Pulsed: RF amplifier	0.5	9	25	10	600	120	250	140.7
Test conditions:	0.240	---	---	---	---	120	250 (max)	---

See footnotes at end of table I.

GENERAL:

Qualification: Required.

TABLE I. Testing and inspection.

Inspection	Method MIL-STD-1311	Notes	Conditions	Acceptance Level 10/	Symbol	Limits Min	Limits Max	Unit
Conformance inspection, part 1								
Total grid current	1266	3/	Ec2 = 400 V	0.65	Ic1	---	-50	μA dc
Electrode voltage (1) (grid)	1261	---	Ec2 = 400 V dc	0.65	Ec1	-17	-35	V dc
Electrode current (screen)	1256	---		0.65	Ic2	-22	+2	mA dc
Electrode voltage (2) (grid)	1261	---	Eb = 6,000 V dc; Ec1/Ib = 5 mA dc	0.65	Ec1	---	-185	V dc
Pulsing emission	1231	3/	eb = ec2 = ec1 = 850 v	0.65	is	80	---	a
Positive grid voltage	---	5/	Eb = 2,000 V dc; Ec1 = -200 V dc	0.65	ec1	100	300	v
Conformance inspection, part 2								
Primary grid emission (control)	1266	---	Pg1 = 10 watts; t = 300; anode and screen grounded; T(seal) = 100°C ± 15°C	---	Isc1	---	-40	μA dc
Primary grid emission (screen)	1266	---	Pg2 = 25 watts; t = 300; anode and grid grounded; T(seal) = 100°C ± 15°C	---	Isc2	---	-40	μA dc
Heater current	1301	---		---	If	6.9	8.3	A
Interelement leakage resistance, cold	1366	4/	Supply voltage = 200 V dc; Rs = vary to give full scale deflection with external leads shorted together	---	R	8.0	---	Meg
Pulsed power output	---	2/	eb = 8,000 v; ec2 = 1,000 v; F = 1,215 ± 60 MHz; t = 120	---	po	35	---	kw
Direct-interelectrode capacitance	1331	---	Use shield adapter, RCA Model No. 7506, or equal; all unused electrodes grounded	---	Cg1-k	25	31	pF
					Cg1-g2	33	40	pF
					Cg2-p	5.0	8.0	pF
					Cg1-p	---	0.16	pF
					Cp-k	---	0.01	pF
					Cg2-k	---	1.1	pF

See footnotes at end of table.

TABLE I. Testing and inspection - Continued.

Inspection	Method MIL-STD-1311	Notes	Conditions	Acceptance Level 10/	Symbol	Limits		Unit
						Min	Max	
Conformance inspection, part 3								
Life test	---	---	Group D; pulsed power output; Ef = 6.3 V (max); t = 500 hours	---	---	---	---	---
Life-test end point:	---							
Pulsed power output	---	---		---	po	30	---	kw
Barometric pressure, reduced	1002	9/	Pressure = 140.7 mmHg; 3,000 V dc applied between a and k, with k, g1, and g2 tied together	---	---	---	---	---
Shock (1), specified pulse	1042	6/ 7/ 9/	Test condition A	---	---	---	---	---
Vibration, mechanical	1032	7/ 8/ 9/	Eb = 300 V; Ec2 = 250 V; R1 = 2,000 ohms; Ec1/Ib = 10 mA dc	---	Ep	---	40	V ac

1/ Ratings apply for a maximum "on" time of 10 μs in any 1,000 μs interval. Because the cathode is subjected to considerable back bombardment as the frequency is increased with resultant increase in temperature, the heater voltage should be reduced depending on operating conditions and frequency to prevent overheating the cathode and resultant short life.

2/ Use cathode drive cavity, 10 μs pulse length, 1 percent duty, driving power = 5 kw. Vary Ec1 to obtain anode current during pulse of 9 amperes. The duty factor shall be measured by viewing the rectified rf pulse. Pulse width shall be measured at 0.707 of average of the top of the rectified rf voltage pulse.

3/ This test shall be performed at the conclusion of the holding period.

4/ The tube shall be cooled (room ambient temperature) 30 minutes before performing this test. The resistance between any two electrodes (except across the heater terminals) shall be measured in both directions.

5/ Drive grid positive with a pulse of 8 to 18 μs duration measured at 70.7 percent of the peak value of the pulse. Prr = 60. Adjust positive grid pulse to obtain 28 amperes peak anode current neglecting the overshoot. Positive grid voltage (ec1) is that voltage required to give this peak anode current. The peak value is defined as the maximum value of a smooth curve through the average of the fluctuations over the top portion of the pulse, neglecting the initial overshoot.

6/ The tube shall be subjected to 18 impact shocks (see figure 2 for orientation of axes) as follows: Three shocks in each of the mutually perpendicular axes in any sequence: Y+, Y-, X+, X-, Z+, and Z-. This is not a destructive test.

7/ There shall be no shorts or opens after this test. Tubes shall meet the limits for the following tests after this test: Total grid current, electrode voltage (1) (grid), and electrode current (screen).

TABLE I. Testing and inspection - Continued.

8/ Vibrate along each of the three mutually perpendicular axes (X, Y, and Z, see figure 2) as follows:

Frequency (Hz)	Double amplitude (inches)	Acceleration (G)	Approximate sweep duration (minutes)
5-10	0.08 ± 10 percent		1
10-15		0.41 ± 10 percent	0.5
15-105	0.036 ± 10 percent		2.5
105-2,000		20 ± 10 percent	4

Duration of the cycle shall be at least 8 minutes from 5 to 2,000 Hz. The frequency shall vary approximately logarithmically. This is not a destructive test.

An oscilloscope having a vertical amplifier with a minimum bandpass of dc to 10 MHz, shall be used to monitor the signal across the 2 kΩ series anode resistor. The horizontal scope sweep frequency shall be approximately 1 cm per second. (Full scale vertical deflection shall be at least 250 volts.) The signal shall be dc coupled to the oscilloscope. If a signal greater than 60 volts occurs during the vibration sweep, the tube shall be considered a failure for this test. Sixty volts on the scope approximates 40 volts rms on the Bruel and Kjaer recorder, or equivalent.

The 60 volts referred to herein is deflection only, and does not include the oscilloscope signal resulting from the 10 ma anode current flowing through Rp.

9/ This test shall be performed during the initial production and once each succeeding 12-calendar months in which there is production. An accept on zero defect sampling plan shall be used, with sample of three tubes with an acceptance number of zero. In the event of failure, the test will be made as a part of conformance inspection, part 2, with an acceptance level of 6.5 (see 10/). The "12-calendar month" sampling plan shall be reinstated after three consecutive samples have been accepted. Shock and vibration samples may be formulated by combining tube types of the same basic tube type 7650 or 7651 construction. Sample may be composed by either type or a combination of basic generic types.

10/ This specification sheet uses accept on zero defect sampling in accordance with MIL-PRF-1, table III.

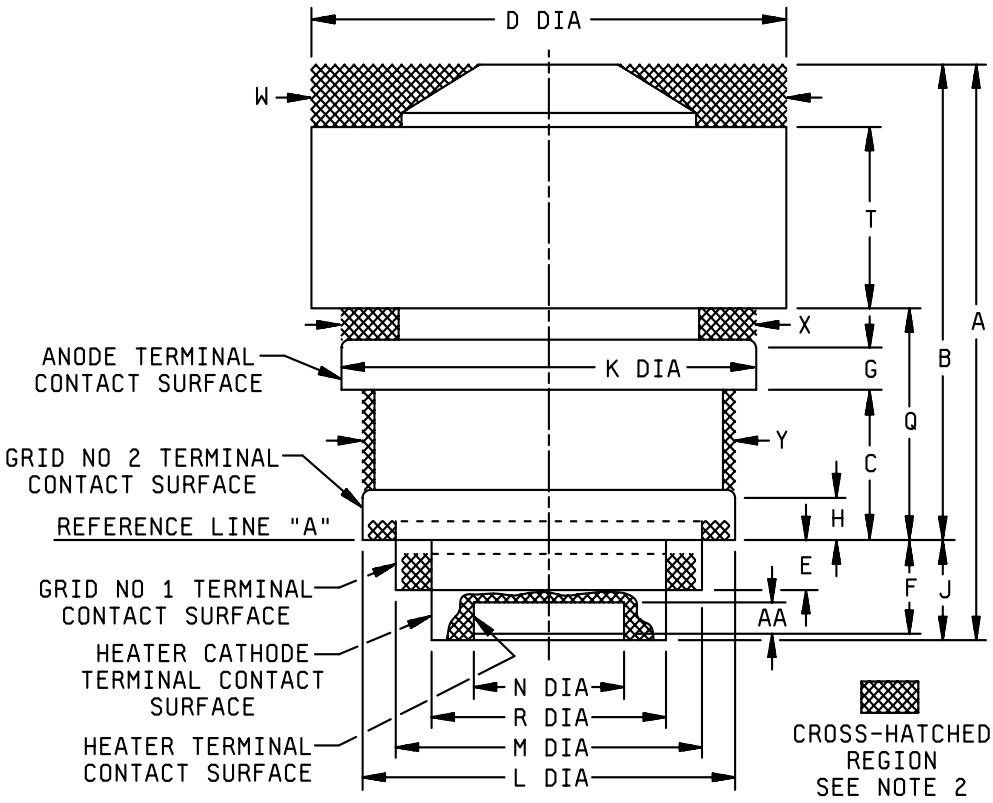


FIGURE 1. Outline drawing of electron tube type 7651.

Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
Conformance inspection, part 1					
	Figure 3 - gauge and note				
Conformance inspection, part 2					
A	---	2.400	---	60.96	
B	1.900	1.980	48.26	50.29	
C	.550	.600	13.97	15.24	
D	2.050	2.080	52.07	52.83	7
E	.180	.220	4.57	5.59	
J	.380	.420	9.65	10.67	
K	1.745	---	44.32	---	6
L	1.590	---	40.39	---	8
M	1.290	---	32.77	---	5
N	---	.670	---	17.02	
Q	.860	.930	21.84	23.62	
R	.990	---	25.15	---	3
Conformance inspection, part 3					10
F	.360	.410	9.14	10.41	
G	.145	---	3.68	---	
H	.150	---	3.81	---	
T	.735	.775	18.67	19.69	
AA	.115	---	2.92	---	
Reference dimensions					
W	---				4
X	---				1
Y	---				9

NOTES:
1. On any one tube, this dimension shall never be greater than K.
2. Keep all crosshatched regions clear. Do not allow contacts or circuit components to protrude into these annular volumes.
3. Dimension R applies over length J minus E.
4. On any one tube, this dimension shall never be greater than D.
5. Dimension M applies over length E only.
6. Dimension K applies over length G only.
7. Dimension D applies over length T only.
8. Dimension L applies over length H only.
9. On any one tube, this dimension shall never be greater than L.
10. This test shall be performed during the initial production and once each succeeding 12-calendar months in which there is production. An accept on zero defect sampling plan shall be used, with sample of three tubes with an acceptance number of zero. In the event of failure, the test will be made as a part of conformance inspection, part 2, with an acceptance level of 6.5 (see 10/). The "12-calendar month" sampling plan shall be reinstated after three consecutive samples have been accepted. Samples may be formulated by combining tube types of the same basic tube type 7650 or 7651 construction. Samples may be composed of either type or a combination of basic generic types.

FIGURE 1. Outline drawing of electron tube type 7651 - Continued.

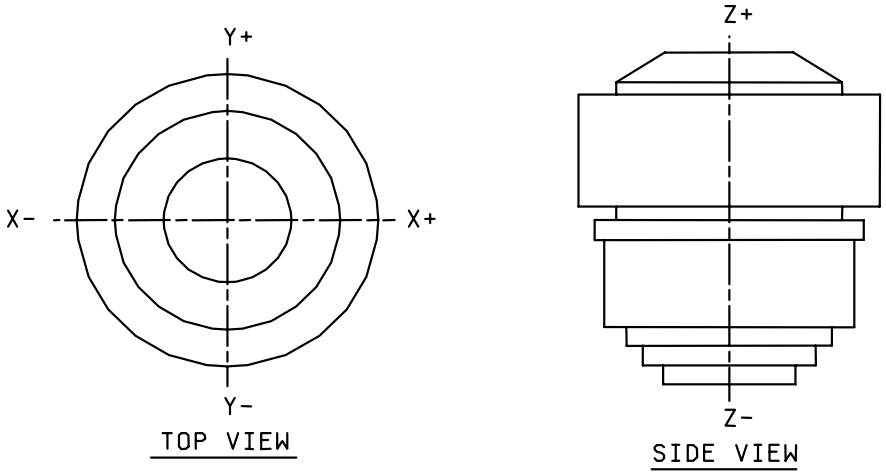
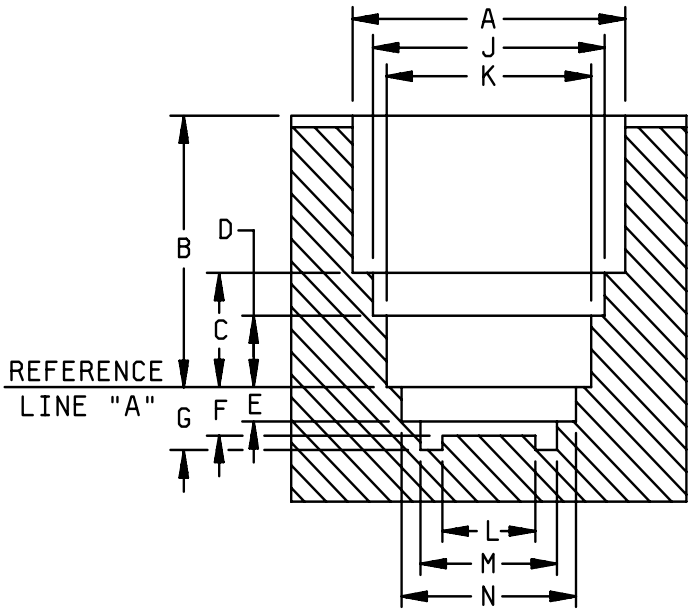


FIGURE 2. Orientation of axes.



Ltr	Dimension			
	Inches		Millimeters	
	Min	Max	Min	Max
A	---	2.112 DIA (H_1)	---	53.64 DIA (H_1)
B	---	1.982	---	50.34
C	.845	.855	21.46	21.72
D	.545	.555	13.84	14.10
E	.215	.225	5.46	5.72
F	.320	.330	8.13	8.36
G	---	.431	---	10.95
J	---	1.801 DIA(H_2)	---	45.75 DIA(H_2)
K	---	1.610 DIA (H_3)	---	40.89 DIA (H_3)
L	.619 (P)	---	15.72 (P)	---
M	---	1.021 DIA (H_5)	---	25.93 DIA (H_5)
N	---	1.321 DIA (H_4)	---	33.55 DIA (H_4)

NOTE: With the cylindrical surfaces of the radiator band, anode terminal, grid No. 2 terminal, grid No. 1 terminal, heater-cathode terminal, and heater terminal clean, smooth and free of burrs, the tube will enter the gauge, to determine out of roundness, concentricity, and over size. Proper entry of the tube is obtained when the grid No. 2 terminal is seated on the shoulder of the reference line. Seating is determined by failure of a .010 inch (0.25 mm) thickness gauge .125 inch (3.17 mm) wide to enter more than .062 inch (1.57 mm) between shoulder surface and grid No. 2 terminal. Slots are provided to permit this measurement to be made. The axes of cylindrical holes H_1 and H_5 and the axis of the post P shall be coincident within .001 inch (0.03 mm). Conformance inspection, part 1, acceptance level 1.0 (see 10/).

FIGURE 3. Gauge.

NOTES

Referenced documents. In addition to MIL-PRF-1, this specification sheet references MIL-STD-1311.

Changes from previous issue. The margins of this specification are marked with vertical lines to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the previous issue.

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